

Effect of different shield environment on laser powder bed fusion **P Bidare¹, I Bitharas², R M Ward³, M M Attallah¹, K Essa¹, A J Moore²**

¹*School of Mechanical Engineering, University of Birmingham, Edgbaston Park Rd, Birmingham B15 2TT*

²*School of Metallurgy and Materials, University of Birmingham, Edgbaston Park Rd, Birmingham B15 2TT*

³*Institute of Photonics and Quantum Sciences, Heriot-Watt University, Edinburgh EH14 4AS, UK*

Corresponding author: p.bidare@bham.ac.uk

Shield environment is fundamental need of laser powder bed fusion (L-PBF) process. The primary functions of a shield environment are to protect melt pool from contamination by atmospheric gases and facilitate process by-products removal in the chamber. The standard shield environment is inert gas (i.e. Argon, Nitrogen) at slightly above (~10 mbar) atmospheric pressure flowing over the bed. Feasibility of L-PBF investigated at sub-atmospheric and in high-atmospheric pressure. A combination of high-speed imaging, schlieren imaging and micrographic assessments is used to understand the effects. At sub-atmospheric pressure: considerable disruption to the powder bed has been observed at sub-atmospheric pressures using high-speed imaging. In high-pressure: reduced particle dynamics, however, increase in spatter and surface roughness was observed.

[1] Bidare P, Bitharas I, Ward RM, Attallah MM, Moore AJ (2018) Fluid and particle dynamics in laser powder bed fusion. *Acta Mater* 142: 107–120.

[2] Bidare P, Bitharas I, Ward RM, Attallah MM, Moore AJ (2018) Laser powder bed fusion at sub-atmospheric pressures, *Int J Mach Tools Manuf* 130-131, 65–72.

[3] Bidare P, Bitharas I, Ward RM, Attallah MM, Moore AJ (2018) Laser powder bed fusion in high-pressure atmosphere, *Int J Adv Manuf Technol* 99, 543-555.